

SNOOPY: STUDENT NANOEXPERIMENTS FOR OUTREACH AND OBSERVATIONAL PLANETARY INQUIRY. K. R. Kuhlman,¹ M. H. Hecht,¹ D. E. Brinza,¹ J. E. Feldman,¹ S. D. Fuerstenau,¹ L. Friedman,² L. Kelly,² J. Oslick,² K. Polk,² L. E. Möller,² K. Trowbridge,² J. Sherman,² A. Marshall,² A. L. Diaz,² C. Lewis,³ C. Gyulai,³ G. Powell,³ T. Meloy,⁴ P. Smith,⁵ ¹Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91109, ²The Planetary Society, Pasadena, CA 91106, ³Visionary Products, Inc., 11814 South Election Drive, Suite 200, Draper, UT 84020, ⁴West Virginia Univ., Morgantown, WV 26506, ⁵The Univ. of Arizona, Tucson, AZ 85721.

Introduction: As scientists and engineers primarily employed by the public, we have a responsibility to “communicate the results of our research so that the average American could understand that NASA is an investment in our future...”[1]. Not only are we employed by the public, but they are also the source of future generations of scientists and engineers. Teachers typically don’t have the time or expertise to research recent advances in space science and reduce them to a form that students can absorb. Teachers are also often intimidated by both the subject and the researchers themselves. Therefore, the burden falls on us -- the space scientists and engineers of the world -- to communicate our findings in ways both teachers and students can understand. Student Nanoexperiments for Outreach and Observational Planetary Inquiry (SNOOPY) provides just such an opportunity to directly involve our customers in planetary science missions.

The Mars Environmental Compatibility Assessment (MECA) Student Nanoexperiments: The MECA Student Nanoexperiment Project was a partnership between MECA, The Planetary Society (TPS) and Visionary Products, Inc. (VPI). The MECA instrument suite, developed at the Jet Propulsion Laboratory (JPL), was scheduled for launch aboard the canceled Mars Surveyor Lander 2001. The MECA Patch Plate was designed to expose various materials to the Martian environment and be observable by the Robotic Arm Camera (RAC). Students 18 years of age and younger were invited to propose experiments that were consistent with MECA’s Mission: to help us better understand how humans will be able to live on Mars.

Each nanoexperiment was required to fit into single MECA Patch Plate (Figure 1) hole, 1 cm in diameter and 1 cm deep, have a mass of 3 g or less, require no power, and require only a single image by the RAC. The students were asked to submit both a short proposal and a prototype of their experiment.

While most entries came from the United States, several were received from Canada, Australia, Brazil, Israel, Japan and the United Kingdom. Two finalists and an alternate were selected based on scientific merit, feasibility and relevance to MECA’s mission. Chosen for flight were “Angle of Repose of Martian Dust,” proposed by Lucas Möller of Moscow, Idaho and “Contradistinctive Copper,” proposed by Jessica Sherman and Kelly Trowbridge of Lansing, New York (Figure 1). These experiments addressed the behavior

of windblown Martian dust on surfaces and the oxidation of different textures of a possible building material, respectively. An alternate nanoexperiment was derived from similar proposals by Adam Marshall of Chapel Hill, North Carolina and Andre Luis Diaz of São Paulo, Brazil, who each proposed to observe the behavior of spacesuit materials in the Martian environment (Figure 2).

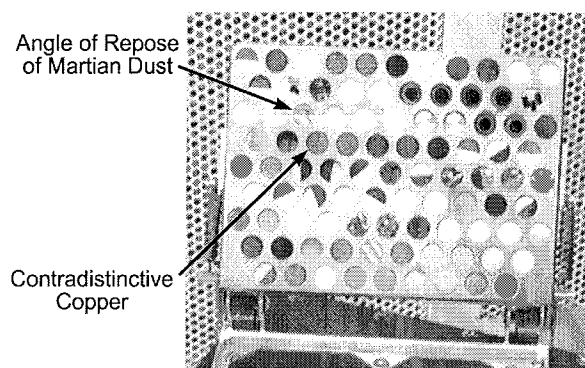


Figure 1. Nanoexperiments in the MECA Patch Plate.

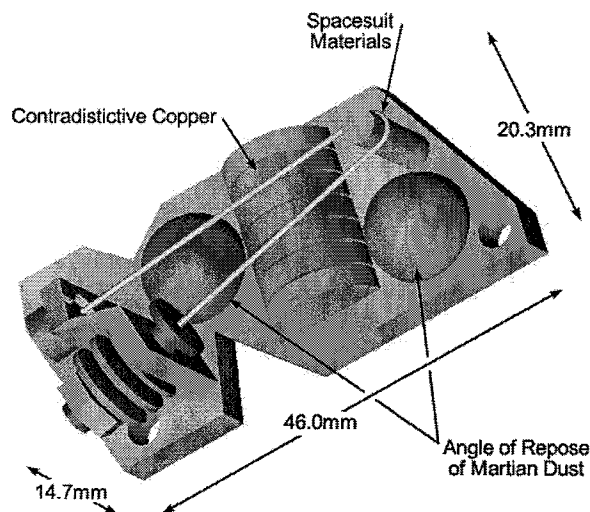


Figure 2. The SNOOPY payload.

An important goal of this project was publication of the students’ work and results in the scientific literature. One student, Lucas Möller presented the results of his Angle of Repose nanoexperiment using JSC Lu-

nar-1 [2] and JSC Mars-1 [3] simulants at the 32nd Lunar and Planetary Science Conference [4].

SNOOPY – Payload Integrated E/PO: The nanoexperiments, now called SNOOPY, have been redesigned with a generic lander interface (Figure 2). The new design allows for uncertainty in the final resting angle of the lander and alleviates imaging problems due to uncertain lighting conditions. We took this opportunity to add the third nanoexperiment, which has been simplified to a single fiber of Kevlar® under tension. The creep of the fiber is measured as a function of time and environmental conditions.

The SNOOPY team plans to produce curricula describing how students and teachers can reproduce the nanoexperiments and perform their own calibration experiments. Should SNOOPY eventually fly, the data returned will be released to students and teachers as soon as it is released to the SNOOPY team. In the interim, the students will publish their calibration results in the scientific literature.

The Future: The education and public outreach goals of SNOOPY are twofold: 1) to provide opportunities for students to participate in planetary science missions and 2) to involve students worldwide in the science return and interpretation on a real-time basis. The first of these goals has been realized even though the original mission has been canceled. The second goal can be partially realized even if SNOOPY does not complete its mission. The Planetary Society and JPL plan to develop curriculum units that allow teachers and students to replicate the calibration experiments of the “student principal investigators” and to compare their results with the official calibrations. Should SNOOPY eventually fly, the images returned will be released on the World Wide Web as soon as

they are made available to the investigators. Students around the world will be able to see and interpret the results and compare them to their own calibrations and to the behavior of their local materials. An online forum will allow the discussion of results.

Lessons Learned: The SNOOPY project demonstrates the value a non-profit organization like The Planetary Society can add to planetary missions. In pursuit of their goal to disseminate knowledge about space exploration, TPS is able to cooperate with the space agencies of the world, translate scientific information into everyday language and reach into classrooms worldwide. By working with small engineering firms like VPI, hardware could be developed quickly and cheaply, without many of the constraints found in government programs.

References: [1] Goldin D. (1999) Testimony before the Committee on Science, U.S. House of Representatives, April 28, 1999. [2] McKay D. S., et al. (1993) *LPSC XXIV*, 963-964. [3] Allen C. C. et al. (1997) *LPSC XXVII*, 27-28. [4] Möller L. (2001) *LPSC XXXII*, Abstract #1470.

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